neo2000®Gamma Detection System

Service Manual
Models 2000 & 2100

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CE 0086

CLASSIFIED C UL US
78NL
UL2601-1
CAN/CSA-C22.2 601.1

Medical Electrical Equipment
With respect to electrical shock,
fire, and mechanical hazards.
only.

℞ ONLY

00-0059 Rev B

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1 Introduction

Purpose

This manual provides the necessary information for an experienced biomedical instrumentation technician to perform routine service operations on the Neoprobe **neo2000®** Gamma Detection System (**neo2000**) in Model 2000 and 2100 configurations.

Scope

This manual gives instructions for the servicing of the **neo2000**, including diagnostic sequences to troubleshoot and isolate failures, assembly sequences required to remove and replace suspect service parts, and performance verification sequences to ensure that the performance of the repaired unit meets Neoprobe specifications. This manual does not include any servicing capability for the Neoprobe gamma detection probes, cables or accessories. These items are not serviceable in the field. This manual does not provide detailed repair procedures and technical documentation to isolate failures to the lowest possible level. It also does not discuss how to perform surgery and procedures for nuclear medicine.

The intent of this manual is not to support the remanufacture and resale of the **neo2000** by third parties.

Servicing Personnel

This manual is intended for use by biomedical instrumentation technicians and other individuals who are familiar with the routine servicing and maintenance of medical electronic instrumentation. (For additional information see Chapter 7.) Those individuals should also be thoroughly familiar with the ***neo2000*** *Operation Manual.*

Customers are not authorized to perform service during the initial one (1) year period.

Training

This manual in conjunction with the ***neo2000*** *Operation Manual* provides all the information that should be necessary for a competent biomedical instrumentation technician to perform the authorized servicing operations. Neoprobe does not provide any supplemental training in the servicing of the **neo2000**.

Customer Feedback

Neoprobe understands the importance of feedback to continual quality improvement, and encourages users and servicing personnel to provide any suggestions for improving the products and this manual. Please forward any suggestions to:

Neoprobe Corporation
425 Metro Place North, Suite 300
Dublin, OH 43017-1367
Attn: Technical Support

or telephone:

(800) 793 0079 (USA only) or
+1 (614) 793 7500

or email:

service@neoprobe.com.

Note: In the unlikely event of a malfunction or failure, Neoprobe recommends that owners of **neo2000®** instruments contact Neoprobe for service.

1.1 Warnings, Cautions and Notes

Overview

Read this section before servicing the **neo2000®**. Included below are warnings, cautions and notes for safe service of the **neo2000**.

Definitions

Service Part: Component used in the **neo2000** that is available as a replacement part for order from Neoprobe by registered owners of Neoprobe **neo2000** products.

Warning: Specific information provided to the service technician to advise of improper servicing of the device that could present potential harm to the service technician, user or patient and/or could result in irreparable damage to the device or property.

Caution: Specific information provided to the service technician to prevent the incorrect servicing of the device which may affect performance or safety of the device.

Note: General information provided to the service technician to further explain or clarify the proper servicing of the device.

Warnings

⚠

- Only biomedical instrumentation technicians or other individuals who are familiar with the routine servicing and maintenance of medical grade electronic instrumentation should service the neo2000.
- Neoprobe shall have no liability for any incident resulting from improper servicing of the neo2000, or from the use of any service parts that are not obtained by authorized Neoprobe sources of supply. (see chapter 9)
- Before servicing, complete the necessary cleaning and inspection process. (see chapter 4.2 of the neo2000 Operation Manual)
- Disconnect the power cord from the power outlet before opening.
- Do not open in the presence of fluids, flammable anesthetics or other explosive gases.
- The internal electronics of the neo2000 are sensitive to damage from electrostatic discharge (ESD). Use appropriate precaution when opening and servicing the unit.
- Neoprobe Corporation does not support the remanufacture and resale of the neo2000 by third parties.
- Returned products must be properly decontaminated in accordance with all applicable regulations for biohazardous material.
- Proper configuration of grounding required for safety.

Cautions

- Replace wire ties and reroute wires as they were initially found.
- Do not leave loose hardware inside the console.
- Conduct normal in-house product safety testing for the neo2000 after servicing and before returning the unit for use on patients.

1.1 Warnings, Cautions and Notes (continued)

Notes

- The volume knob may be damaged by mechanical shock.
- In the unlikely event of a malfunction or failure, Neoprobe recommends that owners of **neo2000**® instruments contact Neoprobe for service.
- Calibration & Preventive Maintenance: The **neo2000** is shipped set to factory specifications. Preventive maintenance is limited to external cleaning of the **neo2000**, fuse replacements and functional diagnostics.
- Replacement of certain items will require reprogramming of the unit. Contact Neoprobe to arrange for reprogramming of the unit.
- Regarding Year 2000 compliance, the **neo2000** Gamma Detection System does not use a Real Time Clock, and subsequently is not adversely affected by Year 2000.
- "Error 1" or "Error No Probe" is a normal operating message when no probe is present. Check probe and cable connections.

2 Specifications

Product Specifications

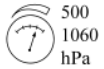
The **neo2000**® complies with the following specifications. Service replacement parts ordered through Neoprobe also comply with the appropriate specifications listed. Personnel performing service on the **neo2000** must understand these specifications and must ensure that all servicing activities performed on the **neo2000** do not compromise any of these specifications.

Product	Classification	Standard or Regulation
System:	Class I, Exempt	USA, 21 CFR § 892.1320
	Class IIa	Europe, Medical Device Directive
	Class II	Canada, Therapeutic Device Regulation
	Class II	Australia, Therapeutic Device Regulation
Model 2000	Type B	EN 60601-1/2 (1)(2)
Model 2100	Type BF	EN 60601-1/2 (2)
Console:	Explosion	Equipment not suitable for use in the presence of Flammable ANASTHETIC MIXTURE WITH AIR or OXYGEN or NITROUS OXIDE
	Fluid Ingress	Ordinary Equipment
	Mode of Operation	Continuous Operation
	Degree of Mobility	Stationary, non-mobile
	Protection against electrical shock	Fused and removable power cable
BlueTip™ Probes	Fluid Ingress	IPX4

(1) The degree of protection from electrical shock is based on the system configured with reusable metal encased probes (Model 1017). When used with the BlueTip™ Probes (Model 2001, 2002, & 2003), the system is Type BF due to the mechanical isolation barrier the plastic material provides.

2) Product safety testing of the initial design is certified through laboratory testing conducted by a certified third party testing laboratory. Ongoing production testing assures that each device continues to comply with these criteria.

2 Specifications (continued)

	Neoprobe Corporation logo		Underwriters Laboratory (UL) recognized symbol component
	In the U.S.A., Caution: Federal Law restricts this device to sale by or on the order of a physician		UL Classified device
	Use by		CE Mark, Class I
	Do not reuse		CE Mark, Class II, Class I Sterile
	Sterile using Ethylene Oxide		Date of manufacture
	Type BF		Storage and Transit Temperature
	Not for use in the presence of flammable anesthetics		Storage and Transit Pressure
IPX4	Splash-proof equipment		Storage and Transit Humidity

2 Specifications (continued)

SN	Serial number		Caution: consult accompanying documents
LOT	Batch code		Consult instructions for use
REF	Catalog number		Standby (push-push) (power on: connections to mains; power off: disconnection from mains)
	Alternating current		Equipotentiality

3 Technical Overview

Overview

This section describes the basic technical features of the **neo2000®** console. Refer to Appendix A.

Processing Architecture

The **neo2000®** contains two processors with distinct functions: the central processing unit (CPU) and the digital signal processor (DSP). The CPU controls the operator interface and some higher level processing functions. The DSP performs a majority of the processing of the probe input signals including many of the formatting and statistical processes associated with counting input pulses. The processors are located on separate circuit boards and use a standard bus structure with the CPU as the master of the bus.

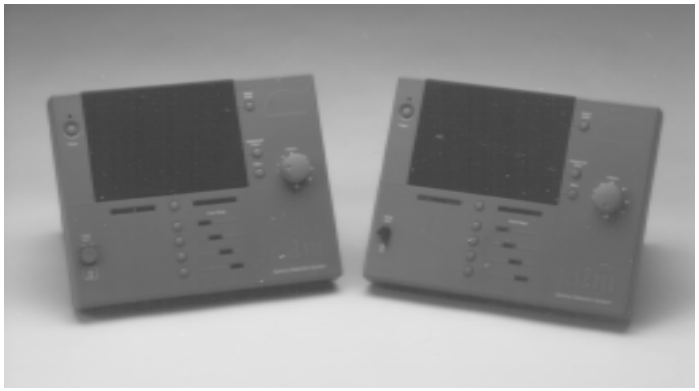


Figure 3-1. **neo2000** Console (Left: Model 2100; Right: Model 2000)

Operator Inputs

Operator control over the console is accomplished through the use of momentary pushbuttons. Most buttons have only one function within a single operating mode.

Volume control is accomplished through use of a rotary input. To maximize flexibility, this rotary input is readable by the software and does not directly control the audible output level. Audible feedback of button presses is provided electronically rather than mechanically.

Operator Outputs

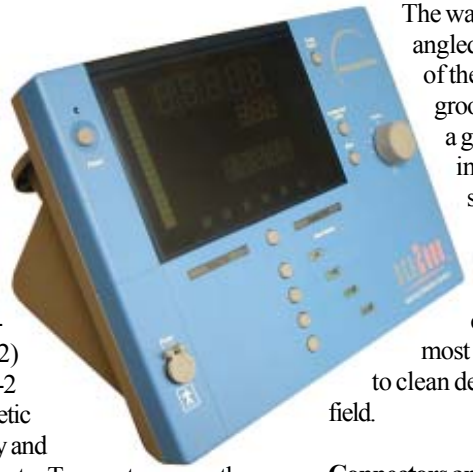
Data from the console is presented to the operator using both visual and audible means. Operational state indicators are provided to clearly indicate the operating mode of the system to the user. Numeric displays present quantitative data for evaluation by the operator. A graphics display and an audio speaker present information in a qualitative manner. Audible data is presented in order to allow the surgeon to keep visually focused on the patient. The audible output produces data and status information simultaneously.

Electronic Input/Output (I/O) Ports

There are two serial I/O ports on the rear of the console. These are used at the factory to program the unit and for future expansion.

Enclosure

The enclosure design complies with the following regulatory requirements: 1) EN 60601-1-1 drop test; 2) EN 60601-1-2 electromagnetic susceptibility and emissions tests. To meet these design requirements, a two piece clamshell enclosure is used.



The enclosure has interlocking ribs combined with a tongue and groove joint to provide strength to pass the drop test. Rigidity of the housing is obtained by screwing the front and rear housings together.

The walls of the housings are angled to allow fluids to flow off of the console. The tongue and groove allows the placement of a gasket to prevent liquid ingress at the location of the seam. The buttons are designed to prevent liquid entry without sacrificing tactile feedback. External components are resistant to most common disinfectants used to clean devices outside of the sterile field.

Connectors and Cabling

The console contains both externally accessible connectors as well as internal cabling. Connectors and cables meet applicable regulatory requirements and environmental conditions.

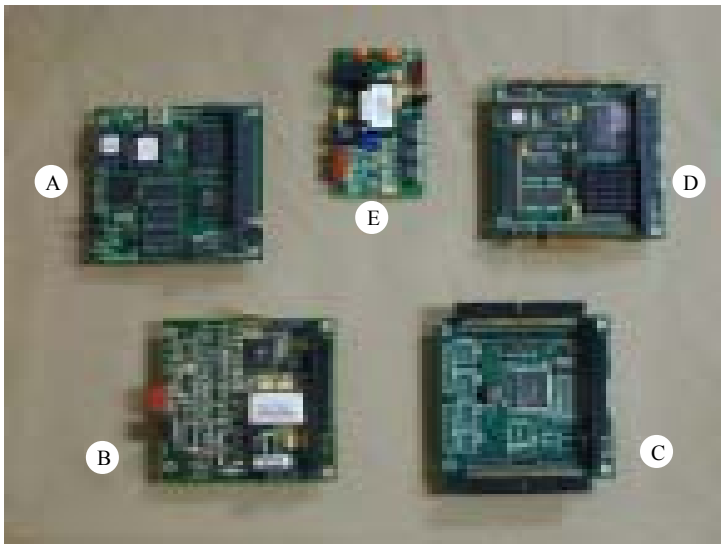


Figure 3-2. **A. DSP Board B. PDM Board C. I/O Board D. CPU Board E. PIM Board(Model 2100 only)**

neo2000® Components

CPU Board *(P101)*
The main CPU board is a 100/133 MHz 486DX based PC/104 board with onboard programming of Flash memory, floppy/IDE interface, serial ports, parallel port, and serial boot loader capability.

I/O Board *(P105)*
The I/O board provides digital expansion channels to meet the total I/O requirements for the **neo2000**.

DSP Board *(P102)*
The DSP is a Starburst DSP board containing a DSP running at 32 MHz. This processor is capable of both 32-bit floating point and 32-bit fixed point operations and has two timers. This board also provides the necessary analog and discrete I/O channels to control and interface with the probe input circuitry.

PDM Board *(P103* or P104**)*
The pulse descriminator module (PDM) board contains the interface circuitry for the external probe. The major components of the PDM board are the signal conditioning circuitry, the power circuitry and the Pulse Discriminator.

PIM Board *(P107**)*
The probe isolation module (PIM) board provides isolation circuits for the interface to the external probe.

Main Board *(P100)*
The Main board serves as a mounting point for most of the displays and switches in the console and also serves as the motherboard for the console.

Auxiliary Board *(P106)*
The auxiliary board serves as a junction box for the rear enclosure half and acts as a mounting point for the I/O connectors and the radionuclide switch.

Power Supplies *(P140, P141)*
The +5V and +12V power supplies are medical grade universal input supplies which accept single phase power between 85 and 264 VAC and 47 to 63 Hz.

Cabling
There are a total of eleven cables and four ground wires in the console. Refer to A.3. The cables consist of:

- Serial port cables *(P120, P121)*
- I/O cables (2) *(P122)*
- Auxiliary board cable *(P132)*
- Line Filter cable *(P124)*
- Power converter cable *(P126)*
- Probe input cable *(P128* or P129**)*
- PIM to PDM cable *(P123**)*
- Speaker cable *(P131)*
- Fan cable assembly *(P150)*
- Line filter ground cable *(P125)*
- Power converter ground cable (2 x*P127)*
- Probe input ground cable *(P130*)*

** Specific to Model 2000*
*** Specific to Model 2100*

Figure 3-3. Top View of the **neo2000®** Front Assembly (Model 2000)

Figure 3-4. Top View of the **neo2000** Front Assembly (Model 2100)

Safety Design

The **neo2000®** Gamma Detection System meets the applicable requirements of the electrical safety and electromagnetic compatibility regulations listed in the Specifications chapter (2.0) of this service manual.

The **neo2000** Gamma Detection System is classified as Class I, Type B (Model 2000) or Type BF (Model 2100) equipment.

The Type B classification is broadly applied to the Model 2000 system, especially when the Model 2000 console is operated with the 14 mm stainless steel (Model 1017) probe. When configured with one of the BlueTip™ Probes (Models 2001, 2002, 2003), the Model 2000 system is classified as Type BF meaning that no earth connection exists between the patient and the equipment. The Model 2100 is classified as Type BF when used with any Neoprobe probes.

Electromagnetic Compatibility

The inside surface of the **neo2000** enclosure is covered with a conductive coating to serve as a shield to electromagnetic radiation. The probe cable and the probe are also shielded to meet emissions and susceptibility requirements at the system level.

Spring finger EMI gaskets are used to bridge the enclosure seam between the front and rear housings without exceeding electrical safety creepage and clearance requirements.

*Personnel performing service on the **neo2000**® must be familiar with the requirements contained in the applicable regulations for electrical safety. The following features of the design must be maintined after any servicing operation to ensure compliance with these regulations:*

Electrical Safety Checklist

- ☐ Green/yellow wires securely fastened
- ☐ Over insulation on all wiring
- ☐ All connectors fully mated
- ☐ Fluid ingress gasket properly installed in housing joint
- ☐ No conductive items protruding from the device (e.g. housing joint, speaker or fan vent)

*Neoprobe Corporation recommends that those servicing the **neo2000** use this list as an Electrical Safety Checklist prior to reassembling the unit.*

*Personnel performing service on the **neo2000** must be familiar with the requirements contained in the applicable regulations for EMC compliance. The following features of the design must be maintained after any servicing to ensure compliance with EMC regulations:*

EMC Compliance Checklist

- ☐ EMI fingers securely fastened and not broken
- ☐ No wires or EMI fingers protruding from housing

*Neoprobe Corporation recommends that those servicing the **neo2000** use this list as an EMC Compliance Checklist while reassembling the unit.*

4 Diagnostic Troubleshooting

Proper System Configuration

The table below gives solutions to correct some problems if the **neo2000®** Gamma Detection System is not operating properly. (Also, see chapters 4.1 & 5 of the ***neo2000*** *Operation Manual*)

Failure Sympton	Potential Cause	Action
Blank screen on power-up	Power cord failed or not connected	Confirm power cord is connected; replace if necessary
	Fuse blown (Note: system requires both fuses for operation)	Confirm continuity of fuses; replace if necessary
	Failed power switch	Confirm power-on LED not illuminated and cooling fan not operating; replace power switch if necessary
	Failed line filter	Confirm continuity through line filter; replace if necessary
	Failed +12v power supply	Confirm power-on LED illuminated (operates directly from +12V supply)
	Failed +5V power supply	Confirm operation of cooling fan (operates directly from +5V supply)
	Failed Power Converter Cable	Confirm continuity of power converter cable; replace if necessary
	Failed Line Filter Cable	Confirm continuity of line filter cable; replace if necessary
	Failed CPU board	Replace CPU board

Failure Sympton	Potential Cause	Action
"Error 1" condition on power-up or during operation with probe connected	Failed Probe	Confirm performance with another probe; replace if necessary
	Failed probe cable	Confirm performance with another probe cable Confirm continuity, check for shorts Replace if necessary
	Failed Probe Supply voltage from **neo2000®**	Confirm +12V output at probe input connector If no +12V output observed: Check for physical damage to probe input connector; replace if necessary Confirm continuity, check for shorts of internal probe input cable, replace if necessary Check +12V output from PIM board (2100) Confirm +12V ouput from PDM board (2000); replace if necessary Confirm +12V input to PIM board; replace PIM to PDM cable if necessary
	Failed PDM Board	Replace PDM board
	Failed I/O Board	Replace I/O board

Failure Symptom	Potential Cause	Action
neo2000® fails to display "Error 1" condition when probe not connected	Failed PIM board (2100)	Replace PIM board (2100)
	Failed PDM board	Replace PDM board
	Failed I/O board	Replace I/O board
*"Error 2" or *"Error 3" conditions on power-up or during operation	Failed CPU or Main board	Cycle power to unit. Return for service if condition persists.
*"Error 4" conditions on power-up or during operation	Failed DSP board	Replace DSP board
	Failed Main board	Replace Main board
*"Error 5" condition on power-up or during operation	Failed DSP board	Replace DSP board
	Failed Main board	Replace Main board
*"Error 5.2" condition during operation	CPU stack over-flow	Cycle power to reset CPU; if condition persists, replace CPU board

* If error persists, contact Neoprobe Corporation for additional technical support.

Failure Symptom	Potential Cause	Action
*"Error 6" condition on power-up or during operation	Failed DSP board	Replace DSP board
	Failed Main board	Replace Main board
Display shows "Idle BLE" on power-up	Application not properly programmed	Return unit to Neoprobe for programming
Display freezes or locks-up during operation	Failed CPU board	Replace CPU board
	Failed Main Board	Replace Main board
No response from **neo2000**® input control buttons	Failed Main Board (front panel buttons)	Replace Main board
	Failed Auxiliary Board (Radionuclide button)	Replace Auxiliary board
	Auxiliary Board Cable failure (Radionuclide button)	Confirm connections, continuity and no shorts in auxiliary board cable; replace if necessary
	Failed I/O Cable	Confirm connections, continuity and no shorts in I/O cable(s); replace if necessary
	Failed I/O Board	Replace I/O board

* If error persists, contact Neoprobe Corporation for additional technical support.

Failure Symptom	Potential Cause	Action
No response or intermittent response to known radiation source	Incorrect energy threshold selected	Confirm that proper radionuclide is selected on **neo2000®**
	Failed probe	Confirm performance with another probe; replace probe if necessary
	Failed probe cable (external cable)	Ensure cable connectors are dry Confirm performance with another probe cable Confirm continuity, check for shorts Replace probe cable if necessary
	Failed Probe Input Cable (internal cable)	Confirm continuity, check for shorts
	Failed Probe Bias Voltage	Confirm >50V output at probe input connector If bias voltage <50V observed: Check for physical damage to probe input connector; replace if necessary Confirm continuity, check for shorts of internal probe input cable; replace if necessary Check for >50V output from PIM board; replace PIM board if necessary (2100) Check for >50V output from PDM board; replace PDM board if necessary (2000)

Failure Symptom	Potential Cause	Action
No response or intermittent response to known radiation source (continued)	Failed PIM board	Replace PIM board (2100)
	Failed PDM board	Replace PDM board
	Failed DSP board	Replace DSP board
Probe gives unexpected high counts without a known radioactive source present	Unknown radiation source present	Check for radioactive material on probe Check for radioactivity on user glove Decontaminate per Operation Manual if necessary Check for persons undergoing radiation therapy
	Failed probe (high electronic noise)	Check for similar readings using ^{125}I radionuclide setting Confirm performance with another probe Replace probe if necessary
	Failed PIM Board	Replace PIM board
	Failed PDM Board	Replace PDM board
	Failed DSP Board	Replace DSP board

4 Diagnostic Troubleshooting (continued)

Failure Symptom	Potential Cause	Action
Probe gives unexpected high counts with a known radioactive source present	Wrong radionuclide selected on **neo2000®**	Select correct radionuclide
LED not illuminated when expected	Failed LED	Confirm LED operation during power-up Confirm LED operation using Diagnostic Menu Replace Main board if necessary
Volume Encoder not functional	Volume Encoder Damaged	Replace Main board or replace volume encoder
No audible response when system detects radiation	System is muted	Press and release mute (mute icon is flashing) button to turn sound on
	Background count set above level of detected radiation	Confirm background count setting
	Speaker Cable failure	Confirm connections, continuity and no shorts in speaker cable; replace if necessary
	Failed Speaker	Replace speaker if necessary

Failure Symptom	Potential Cause	Action
No audible response when system detects radiation (continued)	Auxiliary Board Cable failure	Confirm connections, continuity and no shorts in auxiliary board cable; replace if necessary
	Main Board Failure	Replace Main board
Cooling fan not operating	Failed Cooling Fan	Confirm +5V at cooling fan terminals Confirm fan blades are properly engaged and turn freely Replace cooling fan if necessary
	Auxiliary Board Cable failure	Confirm connections, continuity and no shorts in auxiliary board cable; replace if necessary
	Internal cabling/wiring	Confirm internal cabling/wiring is properly positioned and does not impede fan movement.

5 Disassembly, Service Part Installation and Re-assembly

Overview

This section gives a pictorial step by step instruction of disassembling, repairing, and re-assembling your **neo2000®**. Neoprobe recommends that the servicing technician complete the Service Checklist prior to returning a **neo2000** to operation (see Appendix C).

Step 1.
Remove 5 screws from the rear of the unit with a No. 1 or No. 2 Phillips head screwdriver. Gently pull off volume knob.

Step 2.
Gently separate the front and rear housings. Be careful not to damage the EMI fingers.

Step 3.
Disconnect the auxiliary cable to allow separation of the front and rear assemblies.

Step 4.
After disconnecting the auxiliary cable, support the corners of the front housing to avoid damage to the volume encoder.

Hint: Use two rolls of tape to support front housing.

Caution: The volume encoder may be damaged by mechanical shock.

Step 5.
Using the service manual as a guide, identify the problematic part which needs replacement. Order a replacement part using the Authorized **neo2000®** Parts list (see appendix B).

Now that the part has been replaced, gently reconnect the front housing to the rear housing making sure that nothing protrudes.

Step 6.
Holding the housings together, turn the console to its rear. Reinstall the 5 Phillips head screws which were initially removed.

Warning: The internal electronics of the **neo2000** are sensitive to damage from electrostatic discharge (ESD). Use appropriate precaution when opening and servicing the unit.

6 Performance Verification

Overview

Neoprobe Corporation recommends servicing technicians complete the pre-closure checklists prior to completing the following performance verification checklist for the **neo2000®**. The performance verification checklist is necessary to determine proper operation of the unit. If any problems observed in performance after servicing indicate that the unit is not working, it should be returned to Neoprobe Corporation for evaluation. (See Appendix C for a complete service checklist.)

Operation	Verification	Observation	
Power-Up unit	Verify LEDs	☐	All LEDs lit
	Plug in probe and cable (see Chapter 1.1 of the ***neo2000*** *Operation Manual*)	☐	No probe error disappears
Diagnostic test (see Chapter 4.1 of the ***neo2000*** *Operation Manual*)	VITM - top half display	☐	All indicators lit
	VITM - bottom half display	☐	All indicators lit
	ICTM - button press	☐	All buttons respond
Electrical Safety Tests	per Institute procedure	☐	Complies with institute's procedure
Operational - Dynamic Pitch Mode	Select Dynamic Pitch/Tc-99m/1000cps	☐	Target Count display active
	Position probe over Tc-99 or Co-57 source to get 250cps - 1000cps	☐	Verify display counts and audible response
	Activate Target Count over source (Tc-99 or Co-57)	☐	Verify response to source

Operational - Dynamic Mode (Continued)	Repeat Target Count	☐	Verify consistent operation and resulting cps
	Without moving source select Dynamic Pitch/Tc-99m/100cps	☐	Verify LED, display count, and audio over range
	Without moving source select Dynamic Pitch/I-131/100cps	☐	Verify no response to source

7 Disclaimers

Authorized Service Representatives

Service of the Neoprobe **neo2000**® Gamma Detection System to the extent described in this service manual may be performed by authorized service representatives of Neoprobe Corporation. Any unauthorized servicing operations performed on the **neo2000** shall automatically void the warranty.

Service by Owners of the neo2000

Neoprobe authorizes owners of the **neo2000** , and other independent entities authorized by owners of the **neo2000**, to service the **neo2000** Gamma Detection System to the extent described in this manual. Service of the **neo2000** by owners or other entities may, at Neoprobe's sole discretion, void any remaining warranty on the unit. Neoprobe Corporation shall not be liable for any claim for damages resulting from servicing operations performed on the **neo2000** by owners or other entities authorized by owners.

Parts

Replacement parts used in the repair of the **neo2000** must be obtained through Neoprobe. Neoprobe can not ensure the proper performance of the unit if any replacement parts are obtained from any other source. Use of any unauthorized parts in the repair of a **neo2000** shall automatically void the warranty.

Neoprobe Corporation shall not be liable for any claim for damages resulting from the use of unauthorized parts in the **neo2000**.

Safety

The **neo2000** incorporates safety features in the internal construction and wiring that are necessary to maintain the required electrical safety rating. Personnel servicing the **neo2000** must be familiar with these safety features, and must not compromise any of these safety features. Use of any unauthorized wiring or other compromise of the **neo2000** safety features shall automatically void the warranty.

Neoprobe Corporation shall not be liable for any claim for damages resulting from unauthorized wiring or other compromise to the safety features of the **neo2000**.

Unauthorized Service

Neoprobe Corporation shall not be liable for any claim for damages resulting from unauthorized service of the **neo2000**. This shall include attempts by any person to perform modifications to the product's design such as, but not limited to, rewiring, use of unauthorized parts, and tampering, alteration or abuse of parts or accessories such as cables, wire harnesses, probes, line filters, etc.

8 Service Policy

Overview

This section describes how to obtain warranty and out-of warranty service on the **neo2000®** Gamma Detection System. All service on the **neo2000** must be performed by an authorized service representative of Neoprobe Corporation ("the Company").

Warning: Returned products must be properly decontaminated in accordance with all applicable regulations for biohazardous material.

Warranty Service

To obtain service under your warranty, do the following:
Obtain advance authorization prior to returning any products to the Company. Before returning any equipment, either write or call Neoprobe Corporation at 800-793-0079 or 614-793-7500.

Providethepart number and serial number for the defective product (if applicable), a technical description of the defect or malfunction, a no-charge purchase order, and your appropriate shipping and billing addresses. At the same time, obtain a returned merchandise authorization (RMA) number from Neoprobe.

Return the entire **neo2000** or other product in its original packing. The shipment must be clearly labeled with the RMA number and prepared in accordance with good commercial practices. Shipment to the Company shall be at Buyer's expense. Repaired or replacement equipment will be shipped by the Company to the Buyer with shipping and insurance costs paid for by the Company (C.I.P.). Nonverified problems or defects are subject to an evaluation charge.

Out-of-Warranty Service

To obtain out-of-warranty service, do the following:

Obtain advance authorization and estimate of the service cost prior to returning the product to the Company. Before returning any equipment, either write or call Neoprobe Corporation at 800-793-0079 or 614-793-7500. Provide the part number and serial number for the defective equipment (if applicable), a technical description of the malfunction, a purchase order number covering the Company's estimate of the repair cost, and shipping and billing addresses for the Buyer. At the same time, obtain a returned merchandise authorization (RMA) number.

Return the entire **neo2000** or other product in its original packing. The shipment must be clearly labeled with the RMA number and prepared in accordance with good commercial practices. Shipment to Company shall be at Buyer's expense. Repaired or replacement equipment will be shipped by the Company to the Buyer with shipping and insurance costs paid for by the Company (C.I.P.). Nonverified problems or defects are subject to an evaluation charge.

9 Warranty

Service Warranty. Service and service parts provided by Neoprobe Corporation ("the Company") are warranted against defects in workmanship and materials for a period of 90 days from the date of shipment by Company to Buyer, subject to the limitations hereinafter set forth. Should any defects be found and reported during that period, Company, at its option, will repair or replace such defective equipment provided that Buyer ship the product containing the defect to Company, transportation charges prepaid, with notice of the defect and representation that the equipment has been properly installed, maintained, and operated within the limits of rated and normal usage. The repaired or replacement equipment will be shipped C.I.P. (carriage and insurance paid) from the Company's plant.

This warranty shall not apply to any service parts where the installation or servicing of such service parts is improper, or where service parts are operated above rated load capacity, or subjected to accident, tampering, alteration, or abuse. **THE COMPANY'S LIABILITY UNDER THIS WARRANTY OR ANY OTHER WARRANTY WHETHER EXPRESS OR IMPLIED IN LAW OR FACT SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE MATERIAL AND WORKMANSHIP, AND IN NO EVENT SHALL THE COMPANY BE LIABLE FOR CONSEQUENTIAL OR INDIRECT DAMAGES.**

THIS WARRANTY ALONG WITH ANY APPLICABLE PRODUCT WARRANTY (SEE OPERATION MANUAL) CONTAINS THE ENTIRE OBLIGATION OF NEOPROBE CORPORATION AND NO OTHER WARRANTIES INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY ARE GIVEN.

10 Notices

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A.1 neo2000® Functional Schematic

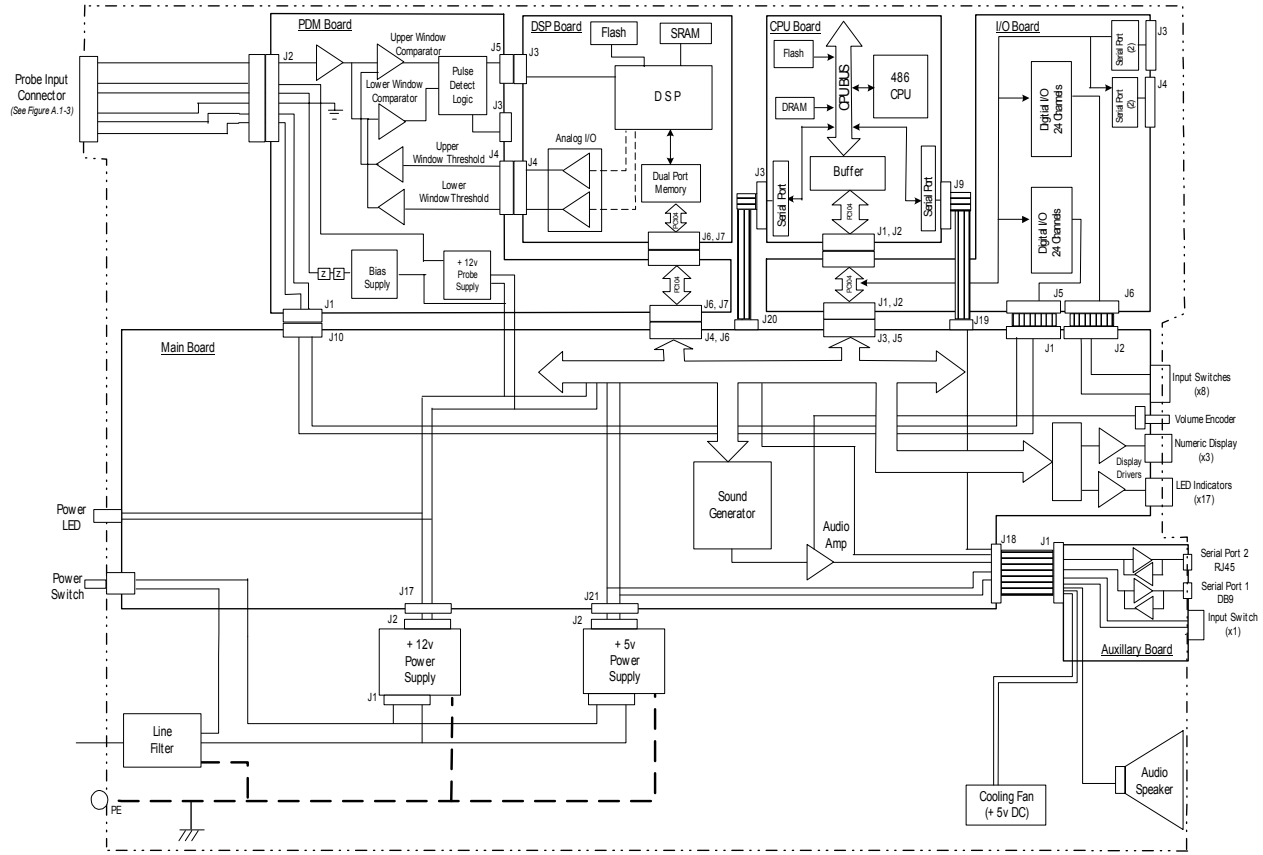


Figure A.1-1. Model 2000 Configuration.

A.1 neo2000® Functional Schematic (continued)

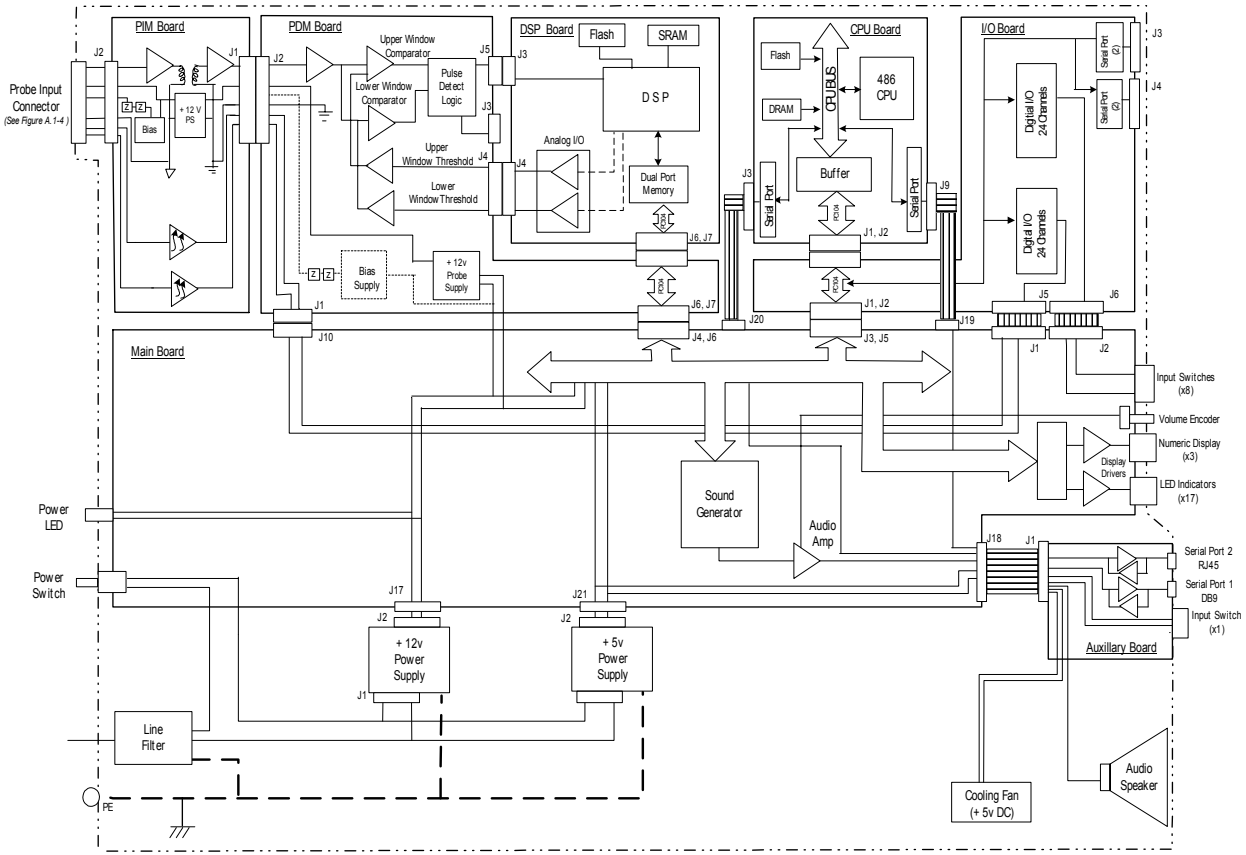


Figure A.1-2. Model 2100 Configuration.

A.1 neo2000® Functional Schematic (continued)

Probe Input Connector Pin Assignments

1	COM	Common
2	SIG	Input Impedance 10kV-30kV
3	+12V	11.4v-12.6v
4	BIAS	>50v
5	CTL 1	5v
6	CTL 2	5v

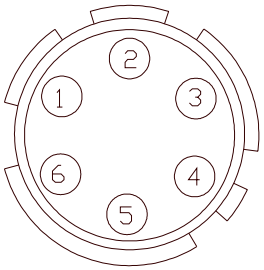


Figure A.1-3. Model 2000 (frontal view of unit)

1	ISOCOM	Common
2	CTL 2	12v
3	CTL 1	12v
4	BIAS	>50v
5	+12V	11.4v-12.6v
6	SIG	Input Impedance 10kV-30kV
7	ISOGND	Common

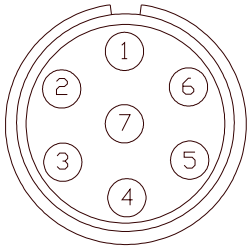
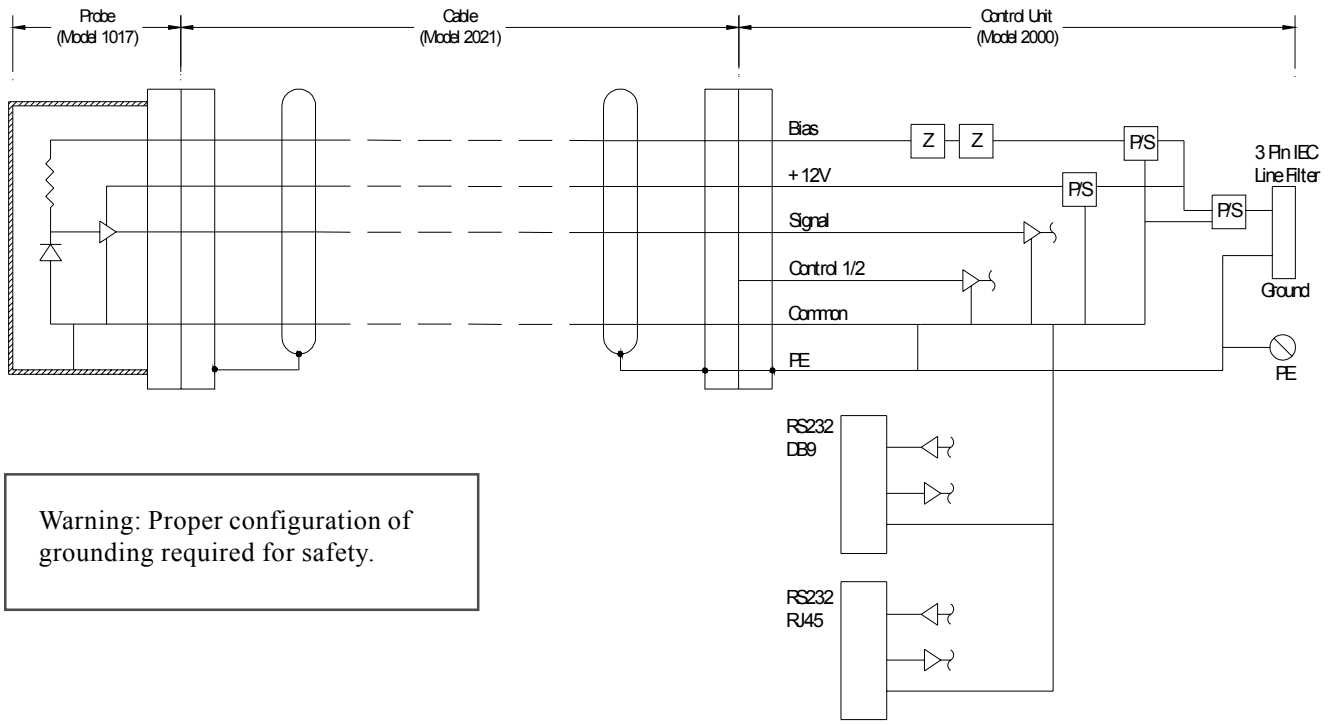


Figure A.1-4. Model 2100 (frontal view of unit)

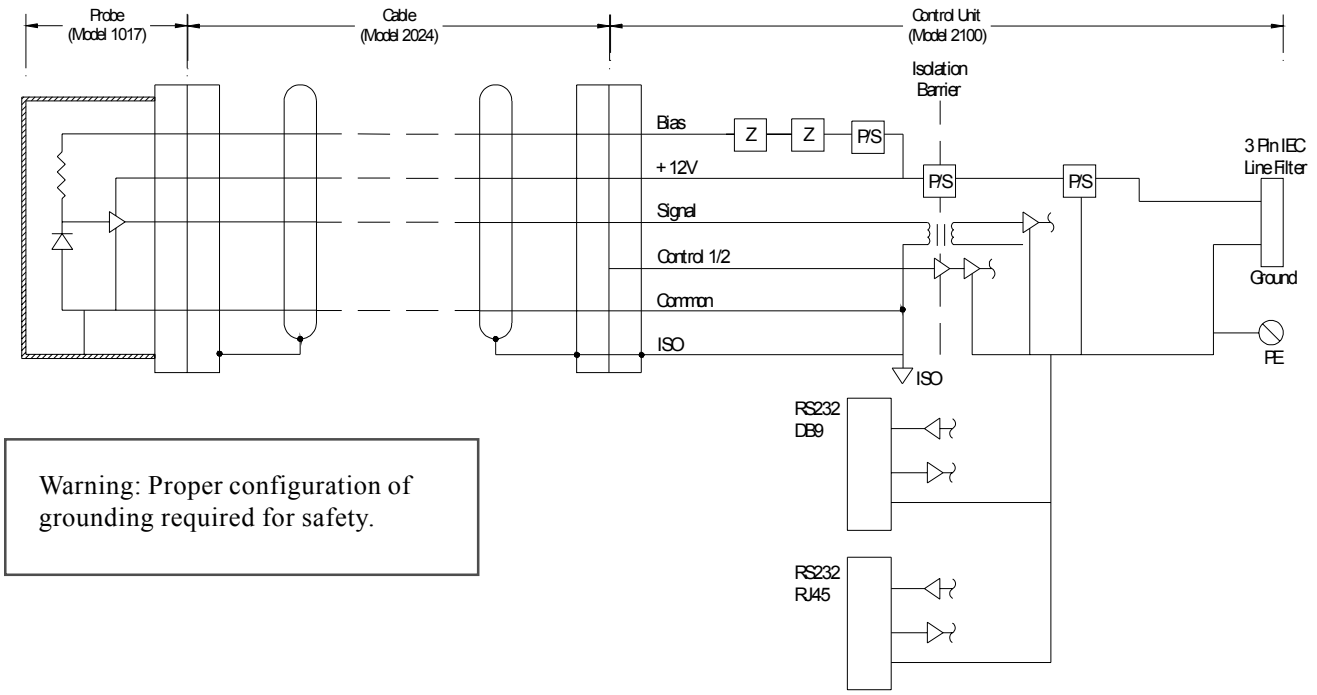
A.2 neo2000® Grounding & Isolation Diagram



Warning: Proper configuration of grounding required for safety.

Figure A.2-1. Model 2000 Configuration.

A.2 neo2000® Grounding & Isolation Diagram (continued)



Warning: Proper configuration of grounding required for safety.

Figure A.2-2. Model 2100 Configuration.

A.3 Front Housing Assembly

1. Front Housing
2. Main Board
3. I/O Board
4. CPU Board
5. 5V Converter
6. PIM Board (Model 2100 only)
7. PDM Board
8. DSP Board
9. 12V Converter

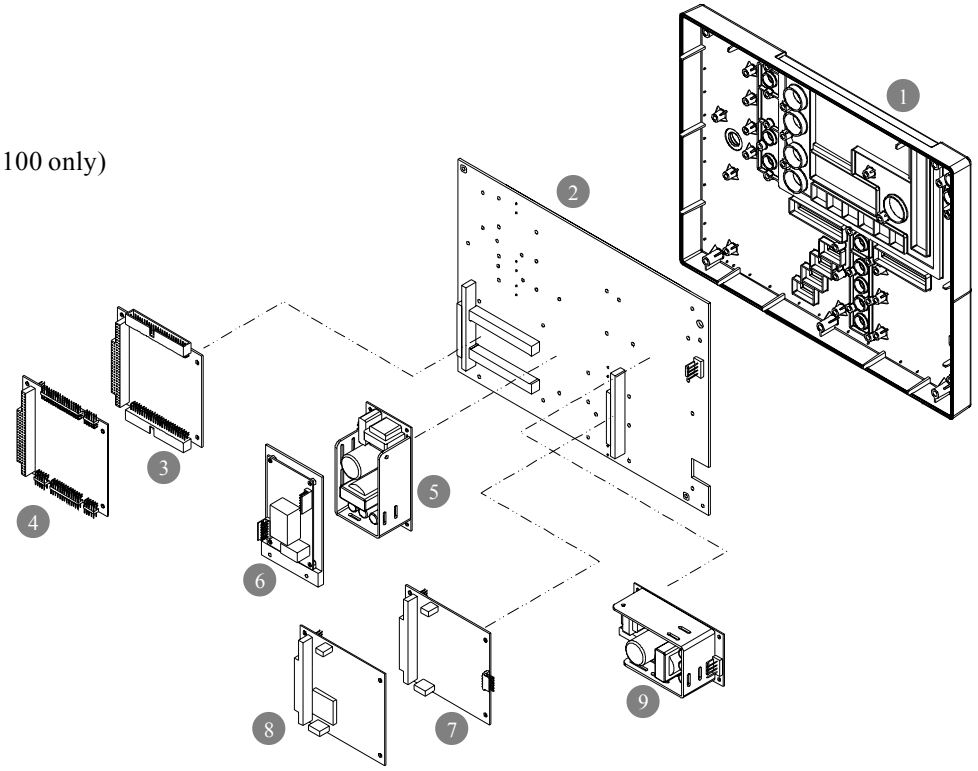
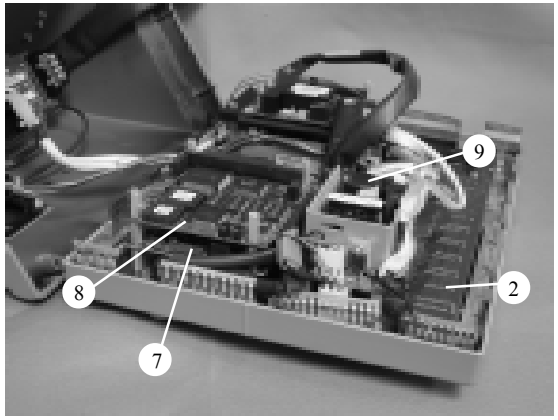


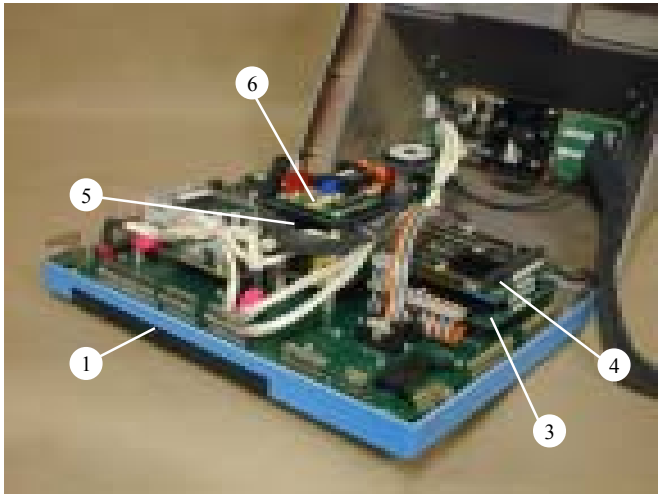
Figure A.3-1. Exploded view.

A.3 Front Housing Assembly (continued)

1. Front Housing
2. Main Board
3. I/O Board
4. CPU Board
5. 5V Converter (positioned under PIM Board)
6. PIM Board (Model 2100 only)
7. PDM Board
8. DSP Board
9. 12V Converter



Left Side View (Model 2100)



Right Side View (Model 2100)

Figure A.3-2. Assembled view.

A.4 Rear Housing Assembly

1. Rear Housing
2. Line Filter
3. Auxiliary Board
4. Fan
5. Speaker

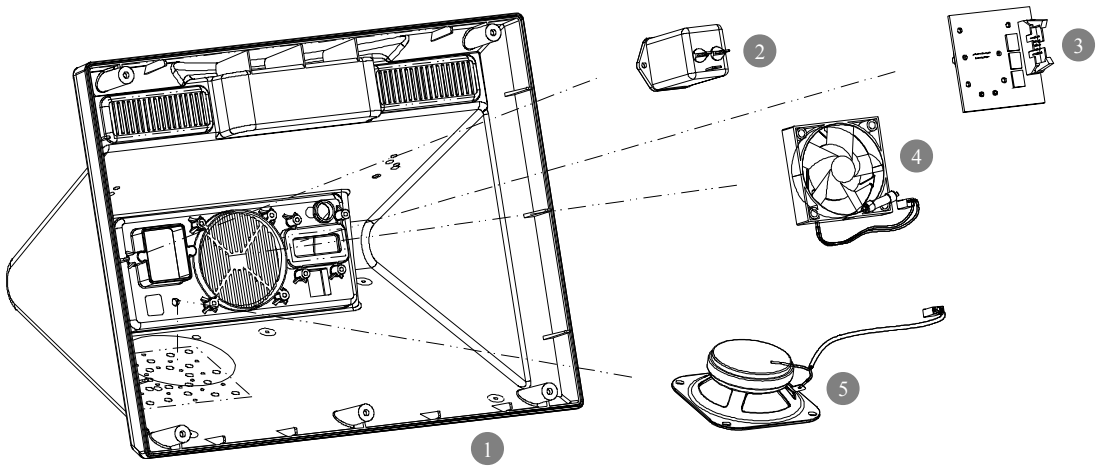


Figure A.4-1. Exploded view.

A.4 Rear Housing Assembly (continued)

1. Rear Housing
2. Line Filter
3. Auxiliary Board
4. Fan
5. Speaker

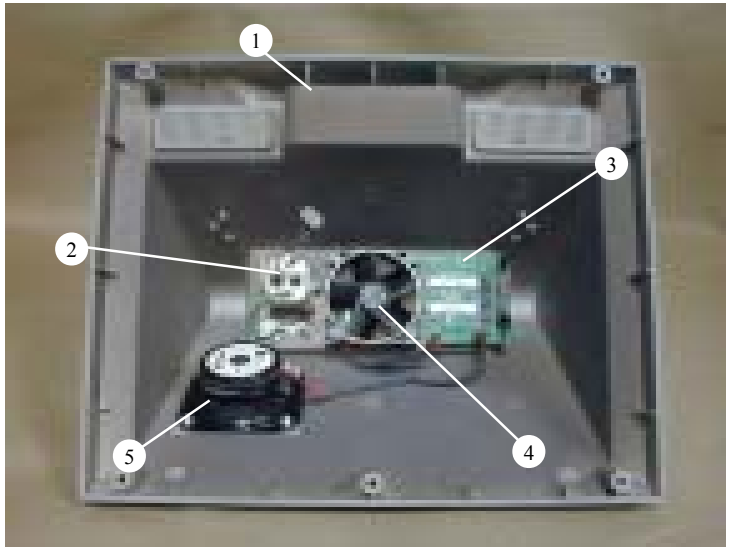


Figure A.4-2. Assembled view.

B Neoprobe Authorized Service Parts

To order Neoprobe Authorized Service Parts contact Neoprobe Technical Support at 800-793-0079 or 614-793-7500. Please make sure to identify your **neo2000**® Model Number and Serial Number and the service parts that you require. Below is a categorized checklist for your convenience when placing an order.

neo2000 Model Number: ☐ Model 2000 ☐ Model 2100

neo2000 Serial Number _____

Software Version _____

BOARDS

- ☐ P100 Main Board
- ☐ P101* CPU Board (V1.03)
- ☐ P108 CPU Board (V2.01)
- ☐ P102* DSP Board (V1.03)
- ☐ P109 DSP Board (V2.01)
- ☐ P103 PDM Board (2000)
- ☐ P104 PDM Board (2100)
- ☐ P105 I/O Board
- ☐ P106 Auxiliary Board
- ☐ P107 PIM Board (2100)

KITS

- ☐ P145 Labeling Kit (2000)
- ☐ P146 Labeling Kit (2100)

CABLES

- ☐ P120 CPU1 Cable
- ☐ P121 CPU2 Cable
- ☐ P122 I/O Cable
- ☐ P123 PIM to PDM Cable (2100)
- ☐ P124 Line Filter Cable
- ☐ P125 Line Filter Ground Cable
- ☐ P126 Power Converter Cable
- ☐ P127 Power Converter Ground Cable
- ☐ P128 Probe Input Cable (2000)
- ☐ P129 Probe Input Cable (2100)
- ☐ P130 Probe Input Ground Cable
- ☐ P131 Speaker Cable
- ☐ P132 Auxiliary Board Cable Assembly

POWER SUPPLY

- ☐ P140 12V Power Supply
- ☐ P141 5V Power Supply

OTHER

- ☐ P150 Cooling Fan Assembly
- ☐ P151 Fuses (2)
- ☐ P152 Speaker
- ☐ P153 Fluid Ingress Gasket
- ☐ P154 Front Housing Shell (2000)
- ☐ P155 Front Housing Shell (2100)
- ☐ P156 Rear Housing Shell
- ☐ P157 Power Switch
- ☐ P158 Line Filter
- ☐ P159 Volume Encoder

* Indicate software version required or contact Neoprobe.

C neo2000® Service Checklist

Neoprobe recommends that servicing technicians complete the following checklist prior to returning a **neo2000** to operation. The completed form should be retained in your files for tracking service history.

Pre-closure Checklist

Electrical Safety (See chapter 3)

- ☐ Green Yellow wires securely fastened
- ☐ Over insulation on all wiring
- ☐ All connectors fully mated
- ☐ Fluid ingress gasket properly installed in housing joint
- ☐ No conductive items protruding from openings in the device (e.g. housing joint, speaker or fan vent)

EMC Compliance (See chapter 3)

- ☐ EMI fingers securely fastened and not broken
- ☐ No wires or EMI fingers protruding

Post-closure Checklist

Performance Verification (See chapter 6)

Power up unit

- ☐ All LEDs lit
- ☐ Plug in probe and cable
- ☐ No probe error disappears

Diagnostic test

- ☐ All indicators lit
- ☐ All buttons respond

Electrical Safety Tests (per institute procedure)

- ☐ All indicators lit

Operational - Dynamic Mode

- ☐ Target count display active
- ☐ Verify display counts and audible response
- ☐ Verify response to source
- ☐ Verify consistent operation and resulting cps (4 times)
- ☐ Verify LED, display count, and audio over range
- ☐ Verify no response to source

Parts replaced: